VIKING HIGH-RESOLUTION TOPOGRAPHY AND MARS '01 SITE SELECTION: APPLICATION TO THE WHITE ROCK AREA. K. L. Tanaka, Randolph L. Kirk, D. J. Mackinnon, and E. Howington-Kraus; U.S. Geological Survey, 2255 N. Gemini Dr., Flagstaff, AZ 86001 (ktanaka@flagmail.wr.usgs.gov)

Introduction: Definition of the local topography of the Mars '01 Lander site is crucial for assessment of lander safety and rover trafficability. According to Golombek et al. [1], steep surface slopes may (1) cause retro-rockets to be fired too early or late for a safe landing, (2) the landing site slope needs to be <10° to ensure lander stability, and (3) a nearly level site is better for power generation of both the lander and the rover and for rover trafficability.

Presently available datasets are largely inadequate to determine surface slope at scales pertinent to landing-site issues. Ideally, a topographic model of the entire landing site at meter-scale resolution would permit the best assessment of the pertinent topographic issues. MOLA data, while providing highly accurate vertical measurements, are inadequate to address slopes along paths of less than several hundred meters, because of along-track data spacings of hundreds of meters and horizontal errors in positioning of 500 to 2000 m [2]. The capability to produce stereotopography from MOC image pairs is not yet in hand, nor can we necessarily expect a suitable number of stereo image pairs to be acquired. However, for a limited number of sites, high-resolution Viking stereo imaging is available at tens of meters horizontal resolution, capable of covering landing-ellipse sized areas [3]. Although we would not necessarily suggest that the chosen Mars '01 Lander site should be located where good Viking stereotopography is available, an assessment of typical surface slopes at these scales for a range of surface types may be quite valuable in landing-site selection. Thus this study has a two-fold application: (1) to support the proposal of White Rock as a candidate Mars '01 Lander site, and (2) to evaluate how Viking high-resolution stereotopography may be of value in the overall Mars '01 Lander site selection process.

Example site: White Rock. We are examining high-resolution stereo pairs (Viking rev 826A, ~24-29 m/pixel) covering part of the deep, 93-km-diameter impact crater centered near 8°S., 335.5°W that contains the well-known, bright feature known as "White Rock" (Fig. 1). This feature has been interpreted as a fine-grained paleolake, perhaps salt-pan, deposit eroded into yardangs by the wind [4-6]

The surface morphologies of White Rock and the surrounding crater floor are complex. White Rock itself appears to have been sculptured by irregular grooves up to several hundred meters wide and several kilometers long. The grooves form two sets oriented perpendicular to one another. One set is pervasive through the deposit, whereas the other mainly forms troughs along the eastern margin of White Rock, giving the outcrops a streamlined, flame-like appearance. The troughs are filled by relatively low-albedo plains material, which may be an eolian mantle. Farther west, the crater floor becomes somewhat lighter in color (see image 826A66). The crater floor is marked by impact craters, wrinkle ridges, and other irregular landforms.

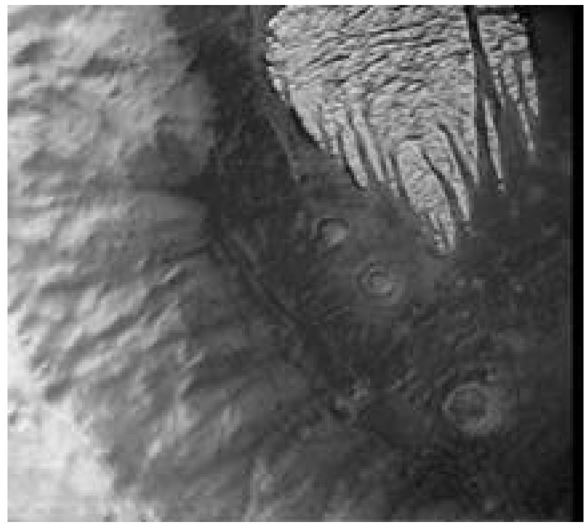

Figure 1. White Rock, Mars (Viking image 826A36; image width, 34 km; north at upper right).

The crater floor is broad enough (~60 km across) to be considered for a Mars '01 Lander site. The site also satisfies current nominal engineering constraints, as follows: (1) rock abundance, 4-5%; (2) fine-component thermal inertia, 4.6 to 5.1 cgs units; (3) elevation, ~0 to 1 km [7].

Approximate stereo topographic measurements of the height of White Rock using the same images that we are working with were performed by Williams and Zimbelman [5]. They estimated a parallax-height ratio based on a *model* depth estimate for a bowl-shaped crater within the scene, rather than on the actual viewing geometry of the images.

Expected results: The Viking 826A images include two sequences taken of the crater floor. One set is with the blue filter, and the other is with the red filter. The parallax-height ratio is ~0.55, which indicates an expected vertical precision of ~10 m. Stereoscopic viewing resolves impact crater rims and ridge and trough features of White Rock and the surrounding plains.

We plan to produce uncontrolled topographic models for one or more of the stereo pairs covering the White Rock area. The models should resolve vertical differences of a few tens of meters across several pixels (~100 m).

This resolution will enable topographic measurements of a variety of landforms at the site, including crater rims, wrinkle ridges, and various eolian features. Many of these features are likely to be common to other proposed Mars '01 Lander sites, and so our analysis should have broad applicability to judging the suitability of proposed sites based on their landforms.

References: [1] Golombek M. P. et al. (1999) *LPS XXX*, #1383. [2] Smith D. E. et al. (1998) *Science 278*, 1758-1765. [3] Kirk R. L. (1999) *LPS XXX*, #1857. [4] Ward A. W. (1979) *JGR 84*, 8147-8166. [5] Williams S. H. and Zimbelman J. R. (1994) *Geology 22*, 107-110. [6] Forsythe R. D. and Zimbelman J. R. (1995) *JGR 100*, 5553-5563. [7] Smith D. E. et al. (1999) *Science 284*, 1495-1503.